

# THE COMPOSITION AND THE DYNAMICS IN POPULATION OF THE DOMINANT CRUSTACEA SPECIES IN MRTVA TISA

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## Abstract

In the period of investigation from 1987 to 1988, a total of 19 Cladocera and 8 Copepoda from Crustacea species was found in Mrtva Tisa.

There was 13 and 18 Cladocera species in both years respectively, i.e. 8 and 6 Copepoda species. The largest number of species appeared in the summer (12 and 14 Cladocera and 6 Copepoda species).

Dominant species were: *B. longirostris*, *Ch. sphaericus*, *D. brachyurum*, *S. crystalina*, *C. vicinus* and *Th. crassus* with highest order of domination (Dt) and rather low frequency of domination (DF), while higher frequency index (pF) and lower order of domination was observed for the following species: *D. cucullata*, *E. gracilis*, *E. serrulatus*.

Among physical and chemical parameters, t °C of water varied the most. During the summer months it was 26 °C. A Decrease in the amount of dissolved oxygen down to 6,8 mg·dm<sup>-3</sup>, followed the increase of water temperature.

Quantitative composition varied also. Total values were greater in 1987. The maximum values for Cladocera and Copepoda (59 and 217 ind·dm<sup>-3</sup>) were recorded during the summer period.

For nauplius however the maximum were in the spring (171). In 1988, maximum values for all three groups were recorded in the summer (Cladocera 117, Copepoda 187 and nauplius 127 ind·dm<sup>-3</sup>)

## Introduction

Crustacea, i.e. Copepoda in the Dead Tisa, Čurug-Biserno, an island-bychannel of the Tisa river were the subject of our former investigations (RATAJAC 1975, 1981). This ecosystem is biologically very productive, providing suitable conditions for the existance of a large number of fish species. Since zooplankton represents a significant component in the dies of many fish species, the aim of this experiment was to investigate the composition and dynamics of population of the dominant Crustacea species.

## Methods and Materials

The material in the Dead Tisa near Čurug was collected during 1987 and 1988. In the first year all seasonal aspects were encompassed, while in the second year samples were taken in monthly intervals. Parallel to sampling for biological analysis, certain physical and chemical parameters were also measured: t °C of water, and pH as well as oxygen dissolved in water. The material was

collected and treated with standard methods. Frequency index (pF), frequency of domination (DF) and order of domination (Dt) was calculated.

$$pF = \frac{m}{n} \cdot 100 \quad DF = \frac{md}{n} \cdot 100 \quad Dt = \frac{DF}{pF} \cdot 100$$

n = total number of samples

m = number of samples in which species were present

md = number of samples in which species were dominant

## Results and Discussion

In the course of investigation in addition to dynamics of population of the dominant Crustacea species, some ecological factors were also monitored, Fig. 1. As can be seen pH values varied slightly, never going over 8.6. Greater variations were experienced with temperature and amount of oxygen dissolved in water. Values for

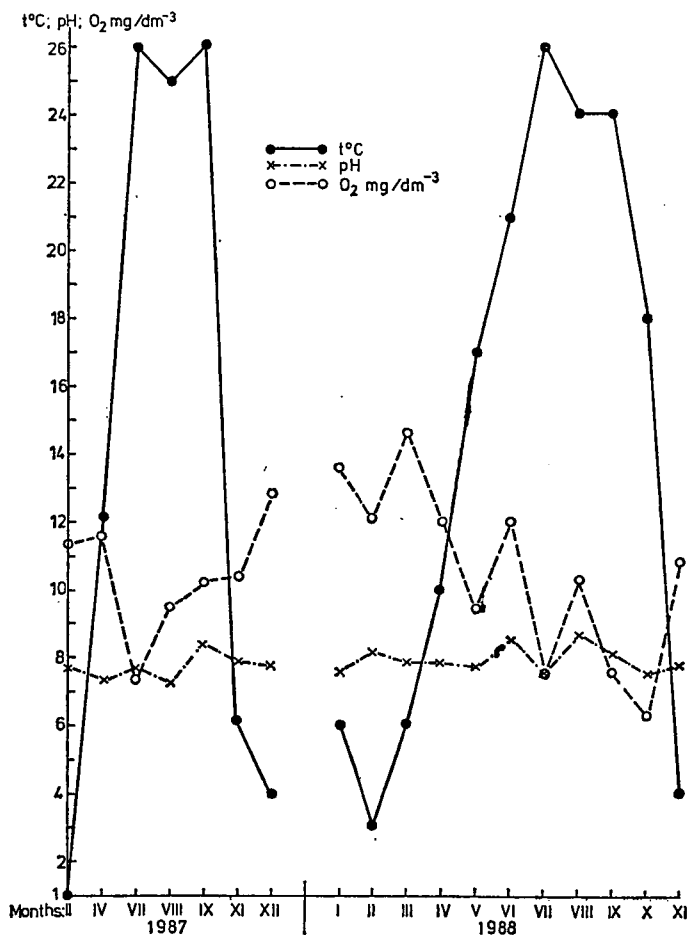


Fig. 1. Some physical and chemical parameters of water in the Dead Tisa near Čurug in the period of investigation

oxygen are rather high, which is quite understandable, keeping in mind the biological productivity of the ecosystem. They were lower when water temperature was higher and vice versa. For the Crustacea as seen in Table 1 during investigation period a total of 19 Cladocera species and 8 Copepoda species were found. So the list of Cladocera species increased compared with our previous investigations (PUJIN and RATAJAC 1988), while the number of Copepoda species remained the same. Quantitative and qualitative composition was different in the years of investigation and varied according to season. In 1987 13 Cladocera species and 8 Copepoda species were recorded. In the second year number of Cladocera species increased to 18 and Copepoda species decreased to 6. Species: *A. harpae*, *L. kirdiii*, *L. leydigii*, *M. laticornis*, *S. mucronata* and *S. vetulus* were not recorded in 1987. A variance in qualitative composition of Copepoda was less expressed in the years of investigations. In the second year of investigation *A. robustus* and *C. strenuus* were not found.

Seasonal variations were also noticeable. The largest number of species in both years was in summer, than in autumn and spring, and the least number in winter. The largest number of species was found in summer of 1988, when 14 Cladocera species and 6 Copepoda species were recorded, while in autumn of the same year 11 Cladocera and 5 Copepoda species were observed. Dominant Cladocera species were: *B. longirostris*, *Ch. sphaericus*, *D. cucullata*, *D. brachyurum* and *S. crystalina*. These species had the highest frequency index, Tabl. 1. Some species had considerable frequency index such as: *A. quadrangularis* and *D. cucullata* in 1987, but low population density. In our previous investigations (PUJIN and RATAJAC 1988) when zooplankton was studied in the period from 1983 to 1987 in the Dead Tisa, aforementioned species were dominant along with *D. longispina*. They were present in each year of investigation. It is interesting to emphasize the presence of *B. coregoni* species in the Dead Tisa, being a rare element of Cladocera fauna in the fauna of Serbia. The presence of periphytonic species should also be underlined: *A. harpae*, *Ch. sphaericus*, *A. excisa*, *S. crystalina* and *S. vetulus*, as well as species specific for litoral and benthos: *M. laticornis*, and representatives of *Scapholeberis* genus which is quite understandable bearing in mind that this ecosystem is rich in phytoplankton and aquatic macrovegetation. However, plankton species are also present such as: *B. longirostris*, representatives of *Daphnia* and *Ceriodaphnia* genus and *D. brachyurum* from Cladocera and *M. leuckarti* and *Th. crassus* from Copepoda. During a warmer part of the year species *D. brachyurum* and *S. crystalina* had higher population density, a rare phenomenon in our waters, and from Copepoda: *M. leuckarti* and *Th. crassus*.

Dominant Copepoda species were: *A. vernalis*, *C. vicinus*, *E. gracilis*, and *Th. crassus*, Table. 1. The highest population density was observed in summer. Species *E. serrulatus* and *M. leuckarti* had considerable frequency index, but small number of individual Copepoda in samples. For *E. gracilis* species frequency index was 100, but frequency of domination and order of domination was not so high as in species *Th. crassus*, which had much higher population density. During all seasons the following Cladocera species were present: *B. longirostris*, *Ch. sphaericus*, *D. cucullata*, and Copepoda *A. vernalis*, *C. vicinus*, *E. serrulatus*, *E. gracilis* and *Th. crassus*.

Group of authors studied planktons in this ecosystem (KALAFATIĆ et al. 1982). They reported 15 Cladocera and 8 Copepoda species. Except a small number of species the same was reported in our investigations.

Similar qualitative composition of Crustacea is observed in the Obed-bara (ŽIVKOVIĆ 1973). This is understandable since there are certain similarities between these ecosystems. Waters are relatively shallow with insignificant motion. The Tisa supplies the Dead Tisa, while the Obed-bara receives its water from the Sava. Area,

Table 1. Qualitative Composition of the Crustacea groups infestated in the dead Tisa near Čurug

Cladocera:	1987								1988							
	W	Sp	Su	A	pF	DF	Dt		W	Sp	Su	A	pF	DF	Dt	
<i>Acroperus harpae</i> (BIRD)											×			9.0		
<i>Alona quadrangularis</i> (O. F. M.)		×	×	×	44.4						×	×		27.3		
<i>Alonella excisa</i> Fischer	×		×	×	33.3							×		18.2		
<i>Bosmina cocegoni</i> BIARD			×		22.2						×	×		18.2		
<i>B. longirostris</i> (O. F. M.)	×	×	×	×	77.7	33.3	42.8		×	×	×	×	81.8	45.4	55.5	
<i>Ceriodaphnia quadrangula</i> (O. F. M.)			×	×	22.2					×		×		27.3		
<i>Chydorus sphaericus</i> O. F. M.	×	×	×	×	66.6	44.4	66.6		×	×	×	×	81.8	45.4	55.5	
<i>Daphnia cucullata</i> Sars	×	×	×	×	77.7				×	×	×	×	72.7	9.0	12.4	
<i>D. Longispina</i> O. F. M.		×			11.1					×		×		18.2		
<i>Diaphanosoma brachyurum</i> (LIEVIN)			×	×	44.4	33.3	75.0				×	×	36.4	18.2	50.0	
<i>Leptodora kindtii</i> (Focke)											×			9.0		
<i>Leydigia leydigii</i> (Schoedler)											×			9.0		
<i>Macrothrix laticornis</i> (Jurine)											×			9.0		
<i>Moina micrura</i> (Kurz) Šramek—Hušek			×		11.1						×	×		27.3		
<i>M. rectirostris</i> (Leydig)			×		11.1											
<i>Scapholeberis kingi</i> Sars			×	×	22.2						×			18.2		
<i>S. mucronata</i> (O. F. M.)											×			9.0		
<i>Sida crystalina</i> (O. F. M.)			×		22.2	11.1	50.0				×	×		27.3		
<i>Simocephalus vetulus</i> (O. F. M.)									×					9.0		
Total	19	4	5	12	8				4	5	14	11				
				13							18					

Copepoda:															
<i>Acanthocyclops robustus</i> (G. O. Sars)			×	×		22.2									
<i>A. vernalis</i> FISCHER	×				×	33.3	11.1	33.3		×	×	×		36.4	
<i>Cyclops strenuus</i> FISCHER	×					11.1									
<i>C. vicinus</i> (ULJANIN)	×	×	×	×	×	66.6	33.3	50.0	×	×	×		54.5	36.4	66.8
<i>Eucyclops serrulatus</i> (FISCHER)	×			×	×	33.3			×	×	×	×	63.6		
<i>Eudiaptomus gracilis</i> Sars	×	×	×	×	×	100	11.1	11.1	×	×	×	×	100.0	9.0	9.0
<i>Mesocyclops leuckarti</i> (LAUS)			×	×	×	33.3					×	×	36.4		
<i>Thermocyclops crassus</i> (FISCHER)	×	×	×	×	×	100	55.5	55.5		×	×	×	81.8	72.7	88.9
Total	8	6	5	6	6					3	5	6	5		
	8					6									
W — Winter; Sp — Spring; Su — Summer; A — Autumn; pF — Frequency index; Dt — Order of domination										DF — frequency of domination;					

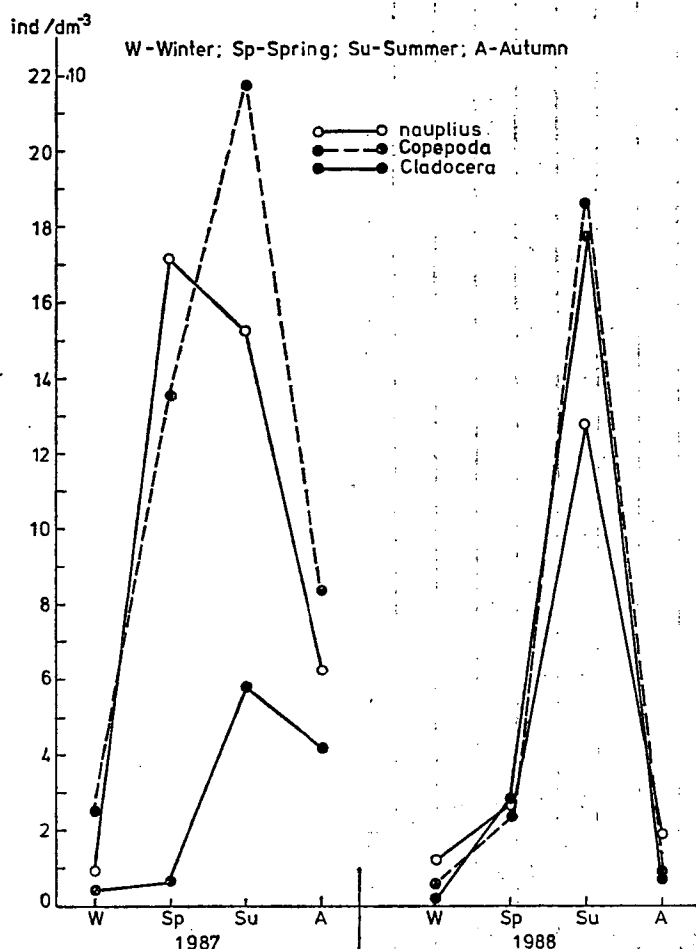


Fig. 2. Quantitative composition of the Crustacea groups investigated in the Dead Tisa near Čurug Table 1. *Qualitative composition of the Crustacea groups investigated in the Dead Tisa near Čurug*

alongside the river is overgrown with macrovegetation. There was considerable difference in the quantitative composition between the years of investigation. Maximum values for Cladocera and Copepoda in the first year of investigation were obtained in summer and for nauplius stages in spring, Fig. 2. In the second year of investigation maximum values for all three groups were obtained in summer, than in spring and autumn. In addition to other factors this composition was greatly affected by the temperature which varied considerably in spring of that year due to late snow that unexpectedly fell in spring, Fig. 1. The number of Copepoda species in winter months during the first year was two times higher, i.e. 6 and in the second year 3 species. Total numerical values were lower in the second year of investigation. In both years of investigations the highest values were for Copepoda.

## Conclusion

In the course of 1987—1988 investigation of the composition and dynamics of Crustacea in the Dead Tisa, near Čurug was performed. In that period a total of 19 Cladocera and 8 Copepoda species was found.

Variations in the qualitative and quantitative composition was observed between the years of investigation, as well as between particular season. Number of Cladocera species in the first year of investigation was 13, while in the second year it was 18. Number of Copepoda species in 1987 reached 8, while in 1988. it was 6.

Differences were also evident according to seasons. The greatest number of species was found during summer than in autumn and spring, and the least during winter.

In quantitative composition differences both between years of investigation and various seasons were apparent. In the first year of investigation maximum values for Cladocera and Copepoda were obtained during summer and for nauplius stages during spring. In the second year of investigation maximum values for all three groups were in summer months than in spring and autumn. These differences were caused according to my opinion by water decrease in the spring of 1988.

Most dominant species with the highest frequency index, appearing in all seasons were: *B. longirostris*, *Ch. sphaericus*, *D. cucullata* from Cladocera and *A. vernalis*, *C. vicinus*, *E. serrulatus*, *E. gracilis* and *Th. crassus* from Copepoda. Species *D. brachyurum* and *S. crystalina* had high order of domination but not high frequency index because they were dominant and had great population density in the warmer period of the year.

Periphytonic species were represented by: *A. harpae*, *A. excisa*, *Ch. sphaericus*, *S. crystalina*, *S. vetulus* and *E. serrulatus* and benthos and litoral *M. laticornis* along with representatives of *Scapholeberis* genus. From planktonic species the following representatives of genus were present: *Daphnia* and *Ceriodaphnia*, *B. longirostris*, *D. brachyurum*, *L. kindtii*, *M. micrura*, and *M. leuckarti* and *Th. crassus*.

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## A Crustacea populáció domináló fajainak összetétele és dinamikája a Holt-Tiszában

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### Kivonat

Az 1987—88-as időszakban a Crustacea populációból 19 Cladocera-, ill. 8 Copepoda faj került azonosításra a Holt-Tiszában.

Az első évben 13 Cladocera és 8 Copepoda, a második évben pedig 18 Cladocera és 6 Copepoda fajt azonosítottak. A fajszaám intenzitás a nyári időszakban volt kifejezett (12 és 14 Cladocera-, ill. 6 Copepoda faj).

A domináns fajok közül, amelyeknek a legnagyobb „rang dominanciájuk” volt ezek a *B. longirostris*, *Ch. sphaericus*, *D. brachyurum*, *S. crystalina*, *C. vicinus* és *Th. crassus*; viszont nem volt kiemelkedő a gyakoriságuk (DF); a *D. cucullata*, *E. gracilis* és *E. serrulatus* fajoknak pedig nagyobb frekvencia indexük volt (pF).

A fizikai-kémiai paraméterek közül a víz hőmérséklete ( $t^{\circ}\text{C}$ ) mutatott legnagyobb változást. A nyári időszakban  $26^{\circ}\text{C}$ -t is elérte. A hőmérséklet emelkedésével csökkent az oldott  $\text{O}_2$  mennyisége akár  $6,8 \text{ mg/dm}^3$ -re is. A mennyiségi összetétel ugyancsak változó volt.

Az összértékek 1987-ben magasabbak voltak. A nyár folyamán érték el a maximum értékeket a Cladocera és Copepoda fajok ( $59$  és  $217 \text{ ind/dm}^3$ ), a Nauplius 171-es indexszel tavasszal volt.

A maximum értékeket mindhárom csoport nyáron érte el (Cladocera 177-, Copepoda 187- és Nauplius  $127 \text{ ind/dm}^3$ ).

## Состав и динамика доминантных видов Crustacea в Мертвой Тисе

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### Резюме

В 1987 г. и 1988 г. среди Crustacea в мертвой Тисе было обнаружено 19 видов Cladocera и 8 видов Copepoda. В 1987 г. было обнаружено 13, а в 1988 г. — 18 видов Cladocera и соответственно 8 и 6 видов Copepoda. Летом число наблюдаемых видов было наиболее высоким (12 и 14 видов Cladocera 6 видов Copepoda). Доминантными являлись следующие виды: *B. longirostris*, *Ch. sphaericus*, *D. brachyurum*, *S. crystalina*, *C. vicinus* и *Th. crassus* для этих видов уровень доминантности (Dt) был самый высокий, в то время как их частота доминантности (DF) не всегда была самой высокой. У следующих видов наблюдался самый высокий частотный индекс (pF): *D. cucullata*, *E. gracilis*, *E. serrulatus*, а в то же время более низкий уровень доминантности. Среди химических и физических характеристик самые значительные изменения наблюдали в температуре воды, которая летом достигала до  $26^{\circ}\text{C}$ . С повышением температуры уменьшалось количество растворенного кислорода до  $6,8 \text{ мг/дм}^3$ . Наблюдались также изменения количественного состава. Общие значения, полученные в 1987 г., превышали соответственные результаты 1988 г. Максимальные значения плотности для Cladocera и Copepoda наблюдали летом ( $59$  и  $217 \text{ инд/дм}^3$ ), а для Nauplius — весной ( $171 \text{ инд}$ ). В 1988 г. для всех трех групп максимум наблюдался летом (Cladocera 177, Copepoda 187 и Nauplius  $127 \text{ инд/дм}^3$ ).



## Sastav i dinamika populacija dominantnih vrsta Crustacea u Mrtvoj Tisi

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### Rezime

U ispitivanom periodu 1987—1988. god., u Mrtvoj Tisi, od Crustacea je ukupno konstatovano 19 vrsta Cladocera i 8 vrsta Copepoda. Prve godine je bilo 13, a druge 18 vrsta kladocera i 8 odnosno 6 vrsta kopepoda. Najveći broj vrsta je bio u toku leta, (12 i 14 vrsta kladocera i po 6 vrsta kopepoda). Dominantne vrste su bile: *B. longirostris*, *Ch. sphaericus*, *D. brachyurum*, *S. crystalina*, *C. vicinus* i *Th. crassus* i imali su najveći rang dominacije (Dt), ali ne i veliku čestoću dominacija (DF), dok su veći indeks frekvence (pF) imale vrste: *D. cucullata*, *E. gracilis*, *E. serrulatus* a manji rang dominacije. Od fizičko-hemijskih parametara najviše je varirala  $t^{\circ}\text{C}$  vode. U letnjem periodu je iznosila  $26^{\circ}\text{C}$ . Sa porastom temperature vode opadala je količina rastvorenog kiseonika i do  $6,8 \text{ mg/dm}^3$ . Kvantitativni sastav je takodje varirao. Ukupne vrednosti su bile veće u 1987. god. Maksimalne vrednosti za kladocera i kopepoda, (59 i  $217 \text{ ind./dm}^{-3}$ ) bile su u toku leta, a za nauplius 171 ind., bile su u prolece. U 1988. god., maksimalne vrednosti za sve tri grupe su bile u leto, (kladocera 177, kopepoda 187 i naupliusa 127 ind./dm<sup>3</sup>.)